Photogrammetrics

Photogrammetrics is a technique used to extract reliable measurements from video and/or film. The Photogrammetrics team's technicians, mathematicians and software developers reduce image data received from digital and high-speed video cameras, and also from cinetheodolites and other instrumentation sources. Targets placed on aircraft and stores are tracked frame-by-frame for precision analysis of image data. Projection geometry, nonlinear optimization, and other mathematical techniques are used to reconstruct the optimal 3-degrees-of-freedom (3DOF; x, y, z) or 6-degrees-of-freedom (6DOF; x, y, z, yaw, pitch, roll) trajectory that best matches the 2D tracking data. In addition to the application areas described below, Photogrammetrics also provides analysis for overhead impact scoring, mishap reconstruction and other unique photogrammetric tests.

store separation

Photogrammetric techniques help determine the envelope for safe weapons release from an aircraft. A photogrammetric solution consists of a 6DOF time history, from which velocities and rates can be computed. An important quantity that is derived from the 6DOF time history is the miss distance, which is a time history of the closest point of approach between the surface of the moving store and the surface of another object, such as the aircraft's fuselage, or a fuel tank.

Store separation

ship suitability

Using the Minilir laser tracking system and/or fixed camera(s), the Photogrammetrics team determines the aircraft's 6DOF time history as it touches down and catches the wire. From this information other parameters are calculated, including horizontal speed, sink speed, heading, pitch and roll, glide slope angle and g-force.

Ship suitability

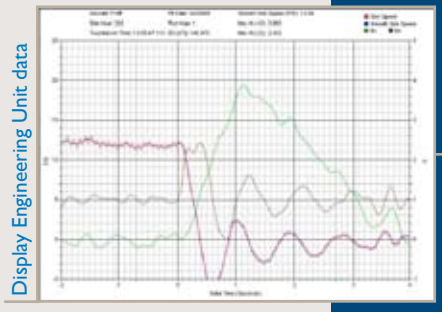
optical TSPI

Using four cinetheodolites strategically located at sites along the Chesapeake Bay, the 3DOF trajectory of an aircraft and/or a store released from the aircraft is estimated using triangulation. The trajectory can then be used to calculate velocities and accelerations. This data is used in applications such as ballistic trajectory calculation, weapons delivery accuracy, and airspeed calibrations.

Optical TSPI

for more information

(301) 342-1197 / 1170 / 3682 / 8640 / 3607 / 1181
23013 Cedar Point Road
Patuxent River, MD 20670
PAXR_ATRCONTACT@navy.mil
www.navair.navy.mil/ranges



Display Engineering Unit data

NAVAIR RANGES
Leaders in providing decision-quality data

January 2009

NAVAIR Public Release #09-153
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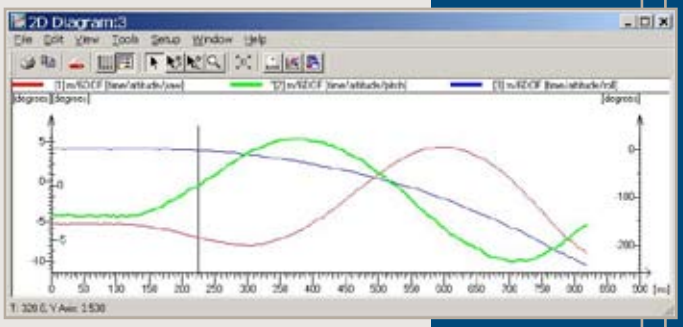
Photogrammetrics

Horizon

The current film and video analysis system, Horizon, is designed to automate the photogrammetric flight test data reduction and analysis process.



TrackEye system integration:

- ATR-developed analysis procedures integrated into Image System's TrackEye software

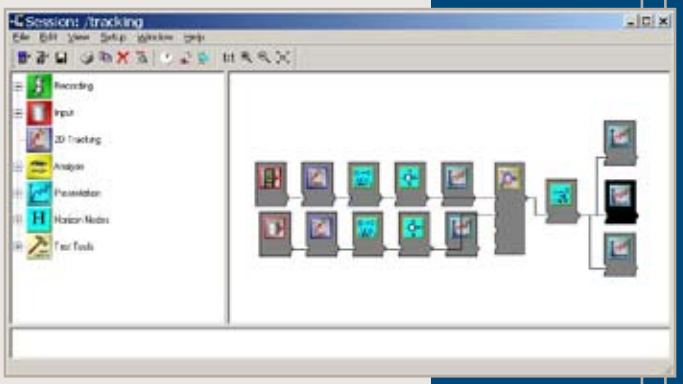
Accuracy:

For store separation data:

- 1 inch in X,Y and Z
- 1 degree in yaw and pitch
- 3 degrees in roll

For ship suitability data:

- 1 foot in X,Y and Z
- 1 degree in yaw, pitch and roll



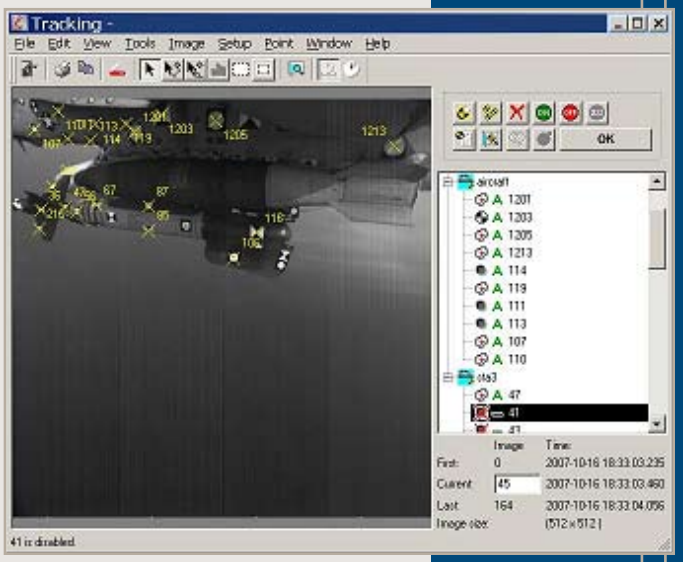
Benefits:

- Data quality assurance and integrity
- Automatic setup procedures to decrease procedural complexity
- Decreased image processing time
- Provides Instant feedback on data quality
- Allows next-day turnaround

future: high-speed photogrammetry

Goals:

- Produce 6DOF less than three hours after a store separation flight, and in a matter of minutes for ship suitability tests
- Produce derived data and missed distance data immediately after 6DOF
- Maintain or exceed current data accuracies



Plans:

- Address high-speed video imagery issues: target occlusion, target reappearance and camera jitter
- Implement an automated target/object tracker that will leverage modular techniques emerging with respect to visual tracking
- Implement a correlation-based tracker that will locate targets directly to generate an ideal image of each target
- Develop pattern recognition and 3-D mathematical modeling

Benefits:

- Improved data accuracies during dynamic multiple object releases